TRANSFORMING HEALTHCARE

Development of a Discharge Readiness Report Within the Electronic Health Record—A Discharge Planning Tool

Amy Tyler, MD[1]*, Ann Boyer, MD, MPH[2], Sara Martin, RN, BSN, CPN[3], Jenae Neiman, RN, MBA[3], Leigh Anne Bakel, MD[4], Mark Brittan, MD, MPH[1]

[1]Section of Hospital Medicine, Children's Hospital Colorado, and Department of Pediatrics, University of Colorado School of Medicine, Aurora, Colorado; [2]Section of Hospital Medicine and Clinical Applications Services, Children's Hospital Colorado, and Department of Pediatrics, University of Colorado School of Medicine, Aurora, Colorado; [3]Department of Quality and Process Improvement, Children's Hospital Colorado, Aurora, Colorado; [4]Department of Pediatrics, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada.

BACKGROUND: With increasingly complex pediatric inpatients, efficient and effective hospital discharge requires optimal interdisciplinary care coordination and communication. We describe the development of a discharge readiness report (DRR) for the electronic health record (EHR), an integrated summary of discharge-related information organized into a highly visible and easily accessible report.

METHODS: We used interviews and process mapping to understand the roles of all disciplines involved in discharge planning and identified key drivers affecting our aim of designing a discharge tool in the EHR. Based on identified key drivers, we designed the DRR and made changes to the report using rapid improvement cycles. The final report includes information necessary for discharge planning organized into 4 domains: potential barriers to discharge, transitional care, home care, and discharge criteria.

RESULTS: The DRR was activated in June 2012. As planned, the final product incorporated previously existing discharge-related information from within the EHR, organized into 1 report. Shortly after its introduction, the DRR was included in daily care coordination rounds (CCRs) for medical and medical subspecialty patients. End users found the report to be completely populated and accurate. We measured time to completion of CCRs and found no difference between duration of CCRs pre- and postuse of the DRR.

CONCLUSIONS: Given widespread adoption, EHRs should be optimized to improve healthcare delivery. A discharge planning tool in the EHR may improve the efficiency and effectiveness of care transitions by allowing for proactive discharge planning and improved interdisciplinary communication. *Journal of Hospital Medicine* 2014;9:533–539. © 2014 Society of Hospital Medicine

According to the American Academy of Pediatrics clinical report on physicians' roles in coordinating care of hospitalized children, there are several important components of hospital discharge planning.[1] Foremost is that discharge planning should begin, and discharge criteria should be set, at the time of hospital admission. This allows for optimal engagement of parents and providers in the effort to adequately prepare patients for the transition to home.

As pediatric inpatients become increasingly complex,[2] adequately preparing families for the transition to home becomes more challenging.[3] There are a myriad of issues to address and the burden of this preparation effort falls on multiple individuals other than the bedside nurse and physician. Large multidisciplinary teams often play a significant role in the discharge of medically complex children.[4] Several challenges may hinder the team's ability to effectively navigate the discharge process such as financial or insurance-related issues, language differences, or geographic barriers. Patient and family anxieties may also complicate the transition to home.[5]

The challenges of a multidisciplinary approach to discharge planning are further magnified by the limitations of the electronic health record (EHR). The EHR is well designed to record individual encounters, but poorly designed to coordinate longitudinal care across settings.[6] Although multidisciplinary providers may spend significant and well-intentioned energy to facilitate hospital discharge, their efforts may go unseen or be duplicative.

We developed a discharge readiness report (DRR) for the EHR, an integrated summary of discharge-related issues, organized into a highly visible and easily accessible report. The development of the discharge planning tool was the first step in a larger quality improvement (QI) initiative aimed at improving the efficiency, effectiveness, and safety of hospital discharge. Our team recognized that improving the flow and visibility of information between disciplines was the first step toward accomplishing this larger aim. Health information technology offers an important opportunity for the improvement of patient safety and care transitions[7]; therefore, we leveraged the EHR to create an integrated discharge report. We used QI

methods to understand our hospital's discharge processes, examined potential pitfalls in interdisciplinary communication, determined relevant information to include in the report, and optimized ways to display the data. To our knowledge, this use of the EHR is novel. The objectives of this article were to describe our team's development and implementation strategies, as well as challenges encountered, in the design of this electronic discharge planning tool.

METHODS
Setting
Children's Hospital Colorado is a 413-bed freestanding tertiary care teaching hospital with over 13,000 inpatient admissions annually and an average patient length of stay of 5.7 days. We were the first children's hospital to fully implement a single EHR (Epic Systems, Madison, WI) in 2006. This discharge improvement initiative emerged from our hospital's involvement in the Children's Hospital Association Discharge Collaborative between October 2011 and October 2012. We were 1 of 12 participating hospitals and developed several different projects within the framework of the initiative.

Improvement Team
Our multidisciplinary project team included hospitalist physicians, case managers, social workers, respiratory therapists, pharmacists, medical interpreters, process improvement specialists, clinical application specialists whose daily role is management of our hospital's EHR software, and resident liaisons whose daily role is working with residents to facilitate care coordination.

Ethics
The project was determined to be QI work by the Children's Hospital Colorado Organizational Research Risk and Quality Improvement Review Panel.

Understanding the Problem
To understand the perspectives of each discipline involved in discharge planning, the lead hospitalist physician and a process improvement specialist interviewed key representatives from each group. Key informant interviews were conducted with hospitalist physicians, case managers, nurses, social workers, resident liaisons, respiratory therapists, pharmacists, medical interpreters, and residents. We inquired about their informational needs, their methods for obtaining relevant information, and whether the information was currently documented in the EHR. We then used process mapping to learn each disciplines' workflow related to discharge planning. Finally, we gathered key stakeholders together for a group session where discharge planning was mapped using the example of a patient admitted with asthma. From this session, we created a detailed multidisciplinary swim lane process map, a flowchart displaying the sequence of events in the overall discharge process grouped visually by placing the events in lanes. Each lane represented a discipline involved in patient discharge, and the arrows between lanes showed how information is passed between the various disciplines. Using this diagram, the team was able to fully understand provider interdependence in discharge planning and longitudinal timing of discharge-related tasks during the patient's hospitalization.

We learned that: (1) discharge planning is complex, and there were often multiple provider types involved in the discharge of a single patient; (2) communication and coordination between the multitude of providers was often suboptimal; and (3) many of the tasks related to discharge were left to the last minute, resulting in unnecessary delays. Underlying these problems was a clear lack of organized and visible discharge planning information within the EHR.

There were many examples of obscure and siloed discharge processes. Physicians were aware of discharge criteria, but did not document these criteria for others to see. Case management assessments of home health needs were conveyed verbally to other team members, creating the potential for omissions, mistakes, or delays in appropriate home health planning. Social workers helped families to navigate financial hurdles (eg, assistance with payments for prescription medications). However, the presence of financial or insurance problems was not readily apparent to front-line clinicians making discharge decisions. Other factors with potential significance for discharge planning, such as English-language proficiency or a family's geographic distance from the hospital, were buried in disparate flow sheets or reports and not available or apparent to all health team members. There were also clear examples of discharge-related tasks occurring at the end of hospitalization that could easily have been completed earlier in the admission such as identifying a primary care provider (PCP), scheduling follow-up appointments, and completing work/school excuses because of lack of care team awareness that these items were needed.

Planning the Intervention
Based on our learning, we developed a key driver diagram (Figure 1). Our aim was to create a DRR that organized important discharge-related information into 1 easily accessible report. Key drivers that were identified as relevant to the content of the DRR included: barriers to discharge, discharge criteria, home care, postdischarge care, and last minute delays. We also identified secondary drivers related to the design of the DRR. We hypothesized that addressing the secondary drivers would be essential to end user adoption of the tool. The secondary drivers included: accessibility, relevance, ease of updating, automation, and readability.

With the swim lane diagram as well as our primary and secondary drivers in mind, we created a mock
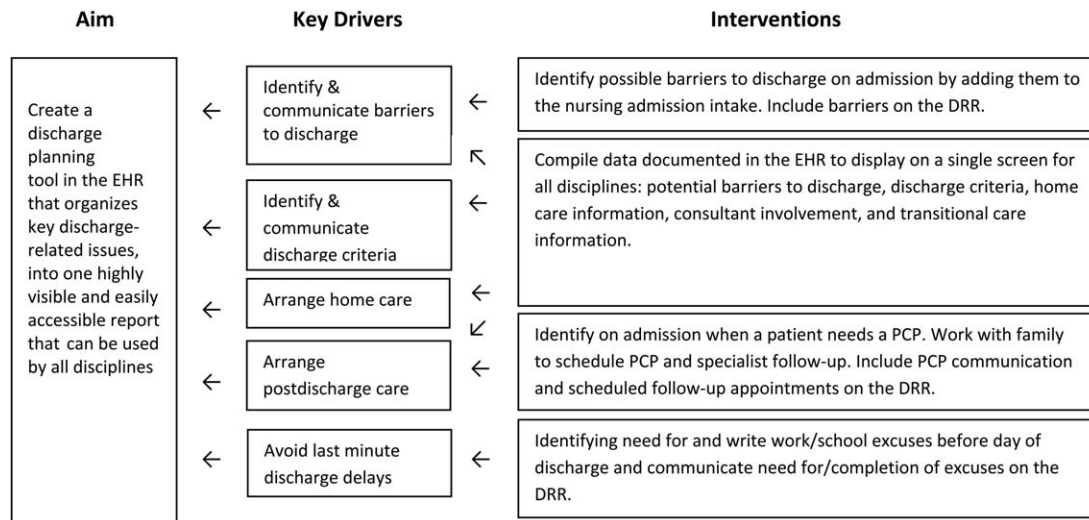
FIG. 1. Key driver diagram. This improvement tool is read from left to right and begins with our aim (left side of the diagram). We used key informant interviews and process mapping to identify the key drivers (center) that affect this aim. We then brainstormed changes or interventions (right side) to address the key drivers. Abbreviations: DRR, discharge readiness report; EHR, electronic health record; PCP primary care provider.

TABLE 1. Discharge Readiness Report Domains

Discharge Readiness Report Domain	Example Content
Potential barriers to discharge	Geographic location of the family, whether patient lives in more than 1 household, primary spoken language, financial or insurance concern, and need for work/school excuses
Transitional care	PCP and home pharmacy information, follow-up ambulatory and imaging appointments, and care team communications with the PCP
Home care	Planned discharge date/time and home care needs assessments such as needs for special equipment or skilled home nursing
Discharge criteria	Clinical, social, or other care coordination conditions for discharge

NOTE: **Abbreviations:** PCP, primary care provider.

DRR on paper. We conducted multiple patient discharge simulations with representatives from all disciplines, walking through each step of a patient hospitalization from registration to discharge. This allowed us to map out how preexisting, yet disparate, EHR data could be channeled into 1 report. A few changes were made to processes involving data collection and documentation to facilitate timely transfer of information to the report. For example, questions addressing potential barriers to discharge and whether a school/work excuse was needed were added to the admission nursing assessment.

We then moved the paper DRR to the electronic environment. Data elements that were pulled automatically into the report included: potential barriers to discharge collected during nursing intake, case management information on home care needs, discharge criteria entered by resident and attending physicians, PCP, home pharmacy, follow-up appointments, school/work excuse information gathered by resident liaisons, and active patient problems drawn from the problem list section. These data were organized into 4 distinct domains within the final DRR: potential barriers, transitional care, home care, and discharge criteria (Table 1).

Additional features potentially important to discharge planning were also incorporated into the report based on end user feedback. These included hyperlinks to discharge orders, home oxygen prescriptions, and the after-visit summary for families, and the patient's home care company (if present). To facilitate discharge and transitional care related communication between the primary team and subspecialty teams, consults involved during the hospitalization were included on the report. As home care arrangements often involve care for active lines and drains, they were added to the report (Figure 2).

Implementation

The report was activated within the EHR in June 2012. The team focused initial promotion and education efforts on medical floors. Education was widely disseminated via email and in-person presentations.

The DRR was incorporated into daily CCRs for medical patients in July 2012. These multidisciplinary rounds occurred after medical-team bedside rounds, focusing on care coordination and discharge planning. For each patient discussed, the DRR was projected onto a large screen, allowing all team members to view and discuss relevant discharge information. A process improvement (PI) specialist attended CCRs daily for several months, educating participants and monitoring use of the DRR. The PI specialist solicited

FIG. 2. Discharge readiness report. Illustration of the report in the electronic health record. Abbreviations: GI, gastrointestinal; GT, gastrostomy tube; ID, infectious disease; O2, oxygen; PCP, primary care provider; PIV, peripheral venous catheter; RLL, right lowerlobe; RMY, Rocky Mountain Youth; RT, respiratory therapy; UTI, urinary tract infection. © 2014 Epic Systems Corporation. Used with permission.

feedback on ways to improve the DRR, and timed rounds to measure whether use of the DRR prolonged CCRs.

In the first weeks postimplementation, the use of the DRR prolonged rounds by as much as 1 minute per patient. Based on direct observation, the team focused interventions on barriers to the efficient use of the report during CCRs including: the need to scroll through the report, which was not visible on 1 screen; the need to navigate between patients; the need to quickly update the report based on discussion; and the need to update discharge criteria (Figure 3).

RESULTS

Creation of the final DRR required significant time and effort and was the culmination of a uniquely collaborative effort between clinicians, ancillary staff, and information technology specialists (Figure 4). The report is used consistently for all general medical and medical subspecialty patients during CCRs. After interventions were implemented to improve the efficiency of using the DRR during CCRs, the use of the DRR did not prolong CCRs. Members of the care team acknowledge that all sections of the report are populated and accurate. Though end users have commented on their use of the report outside of CCRs, we have not been able to formally measure this.

We have noticed a shift in the focus of discussion since implementation of the DRR. Prior to this initiative, care teams at our institution did not regularly discuss discharge criteria during bedside or CCRs. The phrase *discharge criteria* has now become part of our shared language.

Informally, the DRR appears to have reduced inefficiency and the potential for communication error. The practice of writing notes on printed patient lists to be used to sign-out or communicate to other team members not in attendance at CCRs has largely disappeared.

The DRR has proven to be adaptable across patient units, and can be tailored to the specific transitional care needs of a given patient population. At discharge institution, the DRR has been modified for, and has taken on a prominent role in, the discharge planning of highly complex populations such as rehabilitation and ventilated patients.

DISCUSSION

Discharge planning is a multifaceted, multidisciplinary process that should begin at the time of hospital admission. Safe patient transition depends on efficient discharge processes and effective communication across settings.[8] Although not well studied in the inpatient setting, care process variability can result in inefficient patient flow and increased stress among staff.[9] Patients and families may experience confusion, coping difficulties, and increased readmission due to ineffective discharge planning.[10] These potential pitfalls highlight the need for healthcare providers to develop patient-centered, systematic approaches to improving the discharge process.[11]

To our knowledge, this is the first description of a discharge planning tool for the EHR in the pediatric setting. Our discharge report is centralized, easily accessible by all members of the care team, and includes important patient-specific discharge-related information that be used to focus discussion and

	Scrolling through report	Updating Discharge Criteria during CCR's	Navigating between patients and typing in the EHR
Time delays	Scrolling through report	Updating Discharge Criteria during CCR's	Navigating between patients and typing in the EHR
Interventions	Make entire report visible on one screen	Identify a reliable process for updating Discharge criteria prior to CCR's	1. Order rounds to limit the need to navigate between patient lists 2. Identify a team member to navigate/type
Tests of Change	Change headings and re-size sections of the report ⬇ Decrease in scrolling, but team neglecting portions of the report still not visible within the projected area ⬇ Install monitor with improved resolution to display the report	Medical students updated the criteria during medial team rounds using tablets. ⬇ Students needed education on what was meant by "discharge criteria"; students had difficulty participating on rounds while entering the criteria; typing on the tablet was difficult; and the internet connection was inconsistent ⬇ Create system based drop down menus so that discharge criteria could be selected rather than typed in as free text on the tablet. Have interns update the criteria during rounds ⬇ Drop down menus did not eliminate the need for free text; interns encountered same challenges as medical students ⬇ Add section to the resident progress notes entitled "criteria for discharge" and pull content into DRR. ⬇ Section often left blank or deleted from the note by the residents ⬇ Add discharge criteria to the resident sign-out in EHR (already engrained in the resident workflow). Change discharge criteria section of progress note to: "Please update DC criteria in the sign-out. Do not delete this link".	Have case managers navigate DRR ⬇ Not all case managers proficient with navigating the EHR and typing ⬇ Have charge nurses navigate DRR ⬇ Not all charge nurses proficient with navigating the EHR and typing ⬇ Have residents navigate DRR ⬇ Residents facile with navigating/typing. Still an opportunity to decrease navigation between patient lists ⬇ Change order of rounds so that patients are discussed in sequential order by room number beginning with team A, then team B, etc eliminating need to navigate between patient lists in the EHR
Results	Entire report visible on screen without scrolling	Discharge criteria were populated prior to CRR's for all patients and rarely required updating.	Navigating between patients was seamless and no longer prolonged rounds. Typing updates was rarely required and didn't prolong rounds.

FIG. 3. Description of interventions and tests of change to address increased time to complete care coordination rounds (CCRs) postimplementation of the discharge readiness report (DRR). Abbreviations: EHR, electronic health record.

streamline multidisciplinary discharge planning rounds.

We anticipate that the report will allow the entire healthcare team to function more efficiently, decrease discharge-related delays and failures based on communication roadblocks, and improve family and caregiver satisfaction with the discharge process. We are currently testing these hypotheses and evaluating several implementation strategies in an ongoing research study. Assuming positive impact, we plan to spread the use of the DRR to all inpatient care areas at our hospital, and potentially to other hospitals.
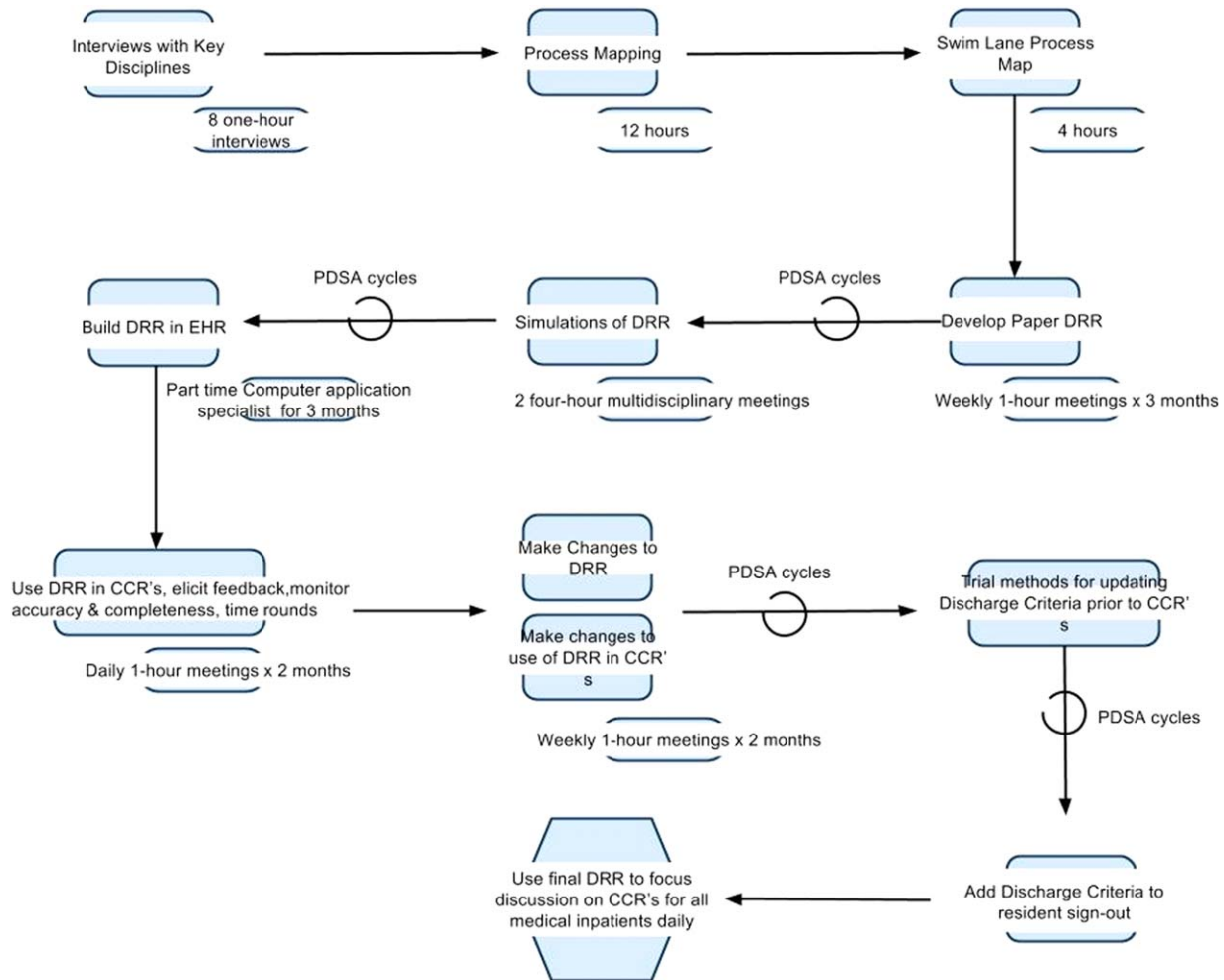
FIG. 4. Time spent and key steps used to design and implement the discharge readiness report (DRR). Abbreviations: CCR, care coordination rounds; EHR, electronic health record; PDSA, Plan Do Study Act.

The limitations of this QI project are consistent with other initiatives to improve care. The challenges we encounter at our freestanding tertiary care teaching hospital with regard to effective discharge planning and multidisciplinary communication may not be generalizable to other nonteaching or community hospitals, and the DRR may not be useful in other settings. Though the report is now a part of our EHR, the most impactful implementation strategies remain to be determined. The report and related changes represent significant diversion from years of deeply ingrained workflows for some providers, and we encountered some resistance from staff during the early stages of implementation. The most important of which was that some team members are uncomfortable with technology and prefer to use paper. Most of this initial resistance was overcome by implementing changes to improve the ease of use of the report (Figure 3). Though input from end users and key stakeholders has been incorporated throughout this initiative, more work is needed to measure end user adoption and satisfaction with the report.

CONCLUSION

High-quality hospital discharge planning requires an increasingly multidisciplinary approach. The EHR can be leveraged to improve transparency and interdisciplinary communication around the discharge process. An integrated summary of discharge-related issues, organized into 1 highly visible and easily accessible report in the EHR has the potential to improve care transitions.

References

1. Lye PS. Clinical report—physicians' roles in coordinating care of hospitalized children. *Pediatrics*. 2010;126:829–832.
2. Burns KH, Casey PH, Lyle RE, Bird TM, Fussell JJ, Robbins JM. Increasing prevalence of medically complex children in US hospitals. *Pediatrics*. 2010;126:638–646.
3. Srivastava R, Stone BL, Murphy NA. Hospitalist care of the medically complex child. *Pediatr Clin North Am*. 2005;52:1165–1187, x.
4. Bakewell-Sachs S, Porth S. Discharge planning and home care of the technology-dependent infant. *J Obstet Gynecol Neonatal Nurs*. 1995;24:77–83.
5. Proctor EK, Morrow-Howell N, Kitchen A, Wang YT. Pediatric discharge planning: complications, efficiency, and adequacy. *Soc Work Health Care*. 1995;22:1–18.

6. Samal L, Dykes PC, Greenberg J, et al. The current capabilities of health information technology to support care transitions. *AMIA Annu Symp Proc.* 2013;2013:1231.
7. Walsh C, Siegler EL, Cheston E, et al. Provider-to-provider electronic communication in the era of meaningful use: a review of the evidence. *J Hosp Med.* 2013;8:589–597.
8. Kripalani S, Jackson AT, Schnipper JL, Coleman EA. Promoting effective transitions of care at hospital discharge: a review of key issues for hospitalists. *J Hosp Med.* 2007;2:314–323.
9. Kyriacou DN, Ricketts V, Dyne PL, McCollough MD, Talan DA. A 5-year time study analysis of emergency department patient care efficiency. *Ann Emerg Med.* 1999;34:326–335.
10. Horwitz LI, Moriarty JP, Chen C, et al. Quality of discharge practices and patient understanding at an academic medical center. *JAMA Intern Med.* 2013;173(18):1715–1722.
11. Tsilimingras D, Bates DW. Addressing postdischarge adverse events: a neglected area. *Jt Comm J Qual Patient Saf.* 2008;34: 85–97.